

State of the Solent Edition 3:

1. Physical Environment & Climate Change

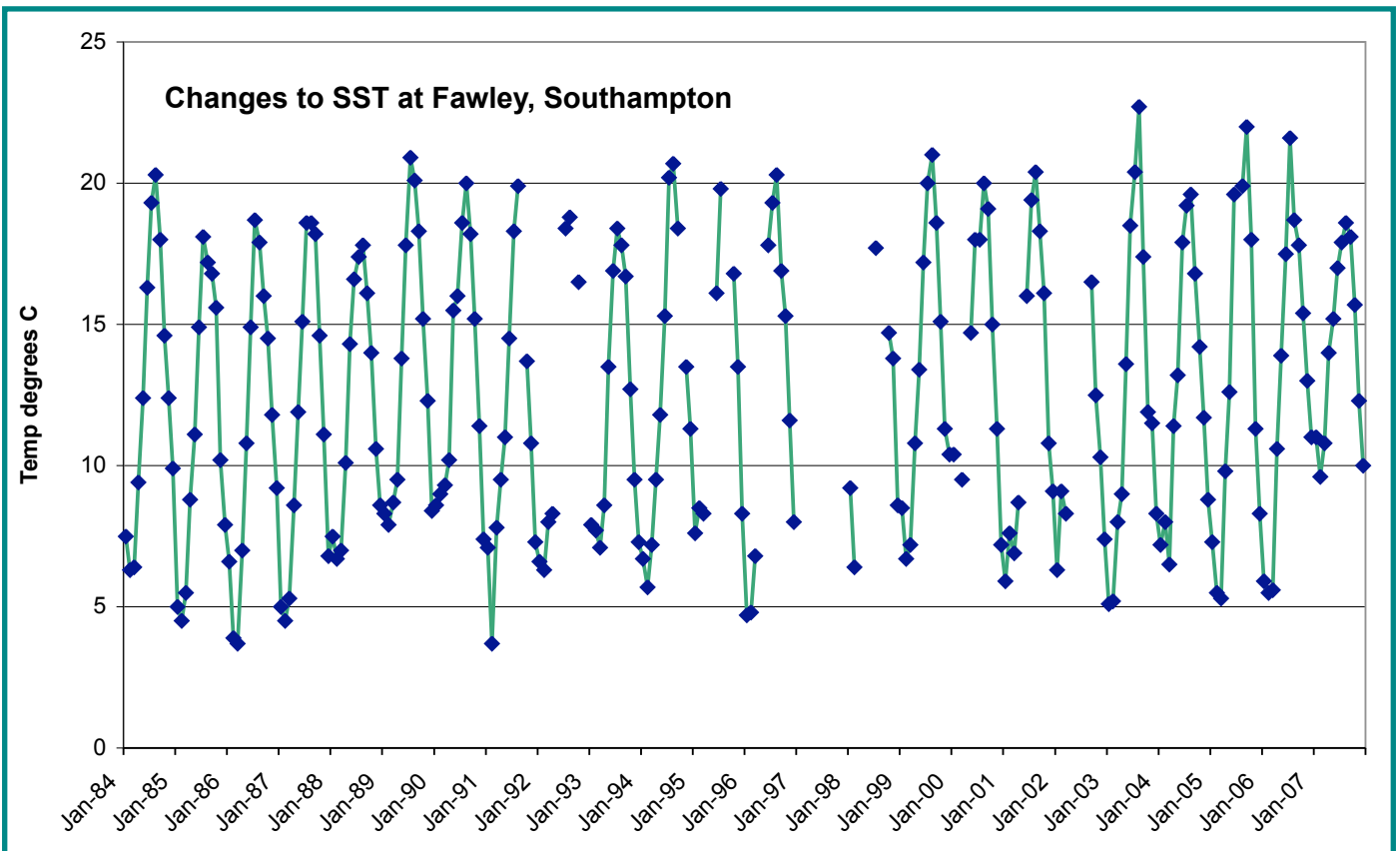


The Solent is an estuarine complex lying on the south coast of the UK, comprising of 12 estuaries and harbours found along the southern Hampshire and Isle of Wight Coastlines. Sea level change has always been a driver in the evolution of the Solent's physical environment with the Solent once being a river. It continues to be a major factor and its continued rise will determine the future coastline of the area.

Climate change is also likely to impact the physical environment of the Solent. Climate change is typically characterised for the southeast of England as trending towards hotter, drier summers and warmer, wetter, winters, with increased storminess. This will have an effect on the natural environment including increase in some plant or bird species and decline in others, leading in turn to adjustments in behaviour of fauna, including migrations. There may also be a significant effect on the coast due to storminess and associated wave and surge actions, with rivers also seeking to discharge higher flows into the sea. This may in turn, affect flooding on the low coast and in river estuaries, as well as erosion of coastal and inter-tidal features such as shingle banks and mudflats.

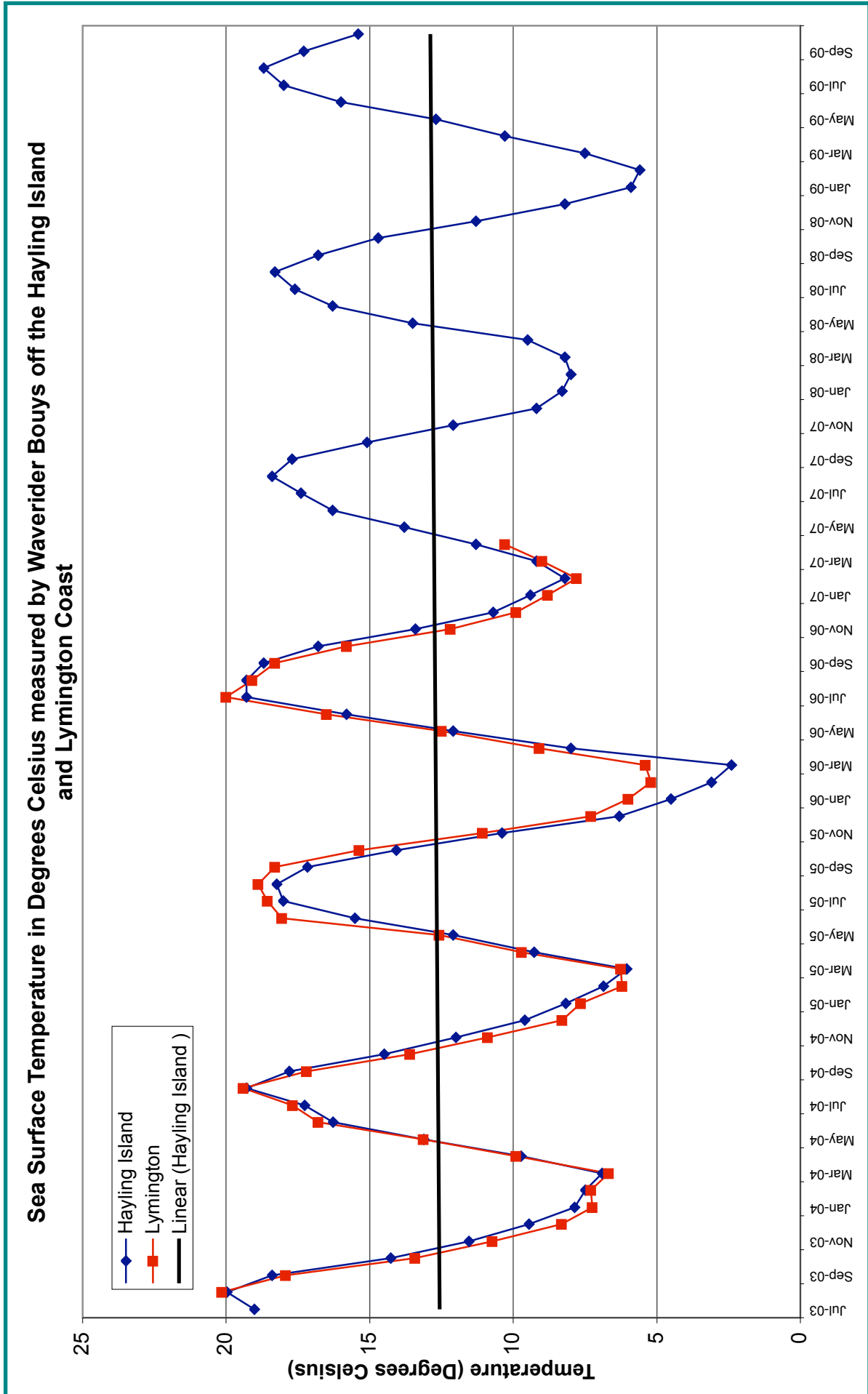
The indicators which have been chosen for this topic all link back to the factors which will impact the physical environment of the coast and this in turn will determine how we use and manage it in the future. These measures should not be looked at in isolation but as part of a suite of climate change indicators or measurements.

1.1 Indicator: Mean Sea Surface Temperature (SST)



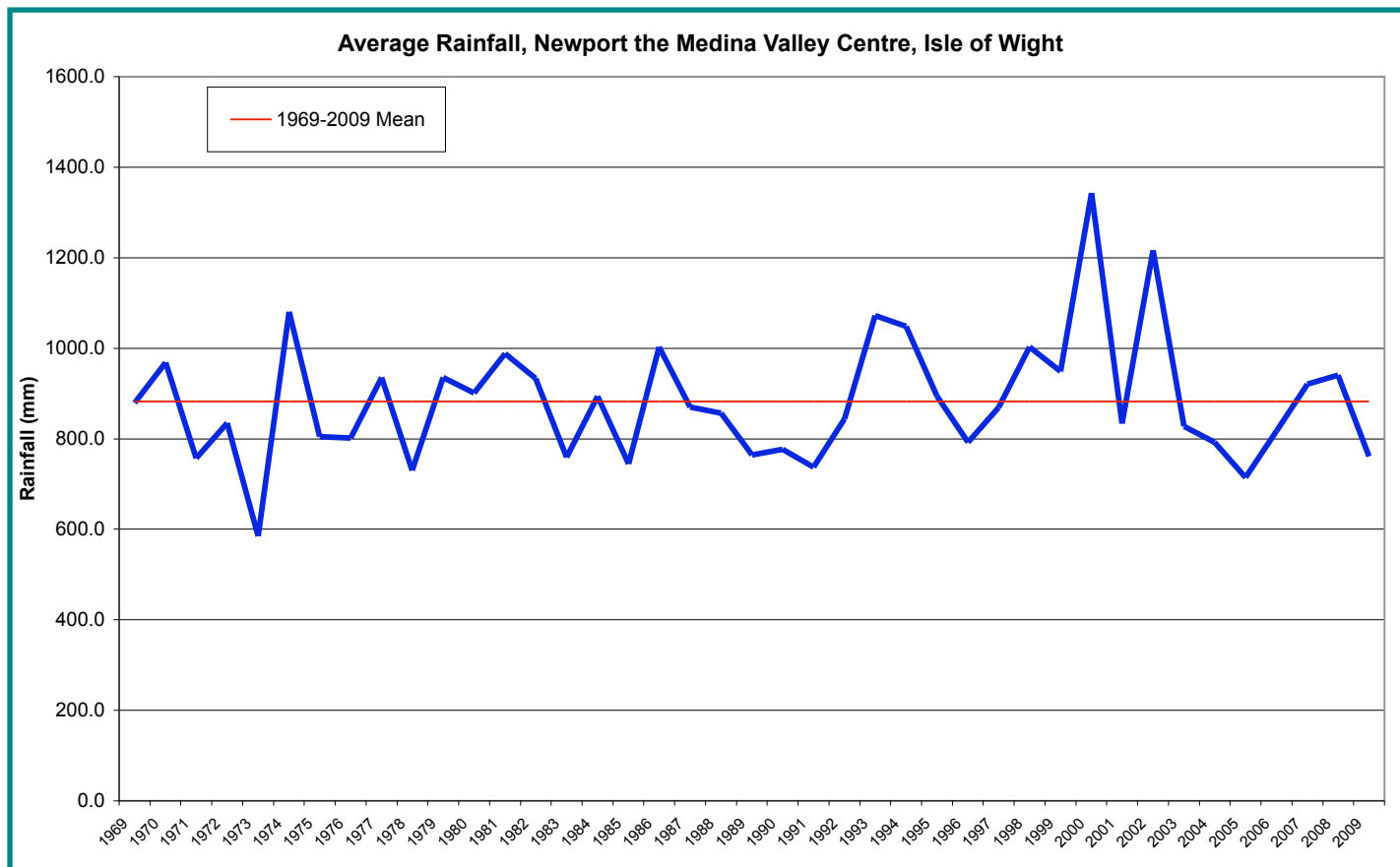
Source: CEFAS

1.1 Indicator: Sea Surface Temperature (SST) Cont...

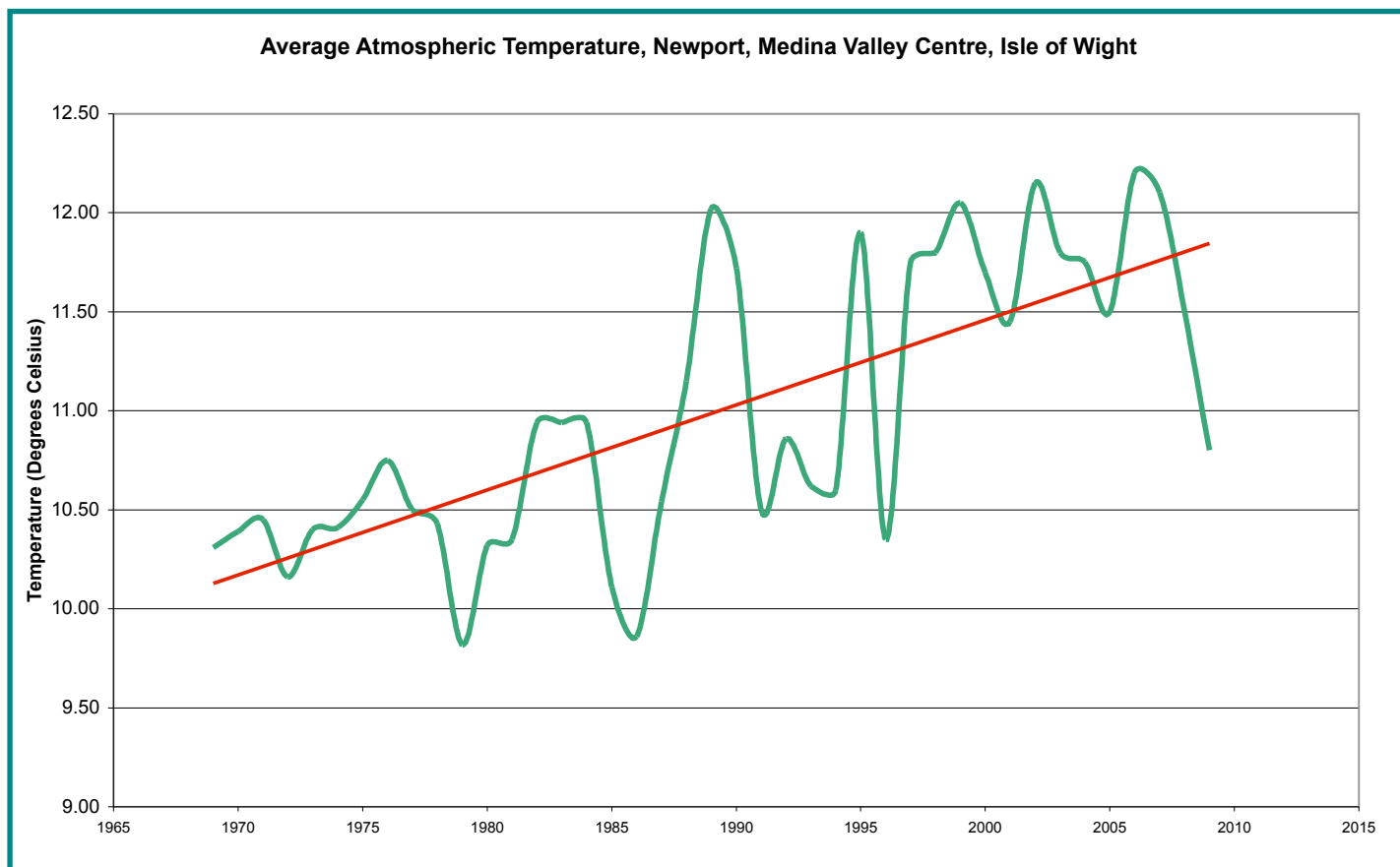


Source: Channel Coastal Observatory

Supplementary Data: Isle of Wight Weather



Source: Medina Valley Centre



Source: Medina Valley Centre

Reason for Indicator Selections

The Solent is located at a transition between different biogeographic realms, therefore, many species within the Solent are at the limits of their natural ranges. Water temperature directly affects the species of plants (such as algae, seagrasses and marsh plants,) and animals (microscopic animals, larger invertebrates, fish, and mammals) that live in the region. In addition, increases in temperature may increase the frequency or extent of blooms of harmful algae. There is widespread belief that global climate change will lead to increases in SST.

This indicator is used both internationally and nationally by a large number of different countries including South Africa, Australia and America and the Helsinki Commission (HELCOM) as one of their climate change indicators. It is also one of the 10 temperature change indicators used by the Met Office and Hadley center and collected by Defra and Centre for Environment, Fisheries and Aquaculture Science (Cefas) so it is widely used at the national level in the UK. This means that local trends can be compared to those at national and international levels.

Additional information has been included on average annual temperature and rainfall from the Medina Valley Centre. These measures will give an indication if conditions in the Solent are responding to climate change in line with national predictions.

Where does the data come from?

The data is freely available on the internet from the Channel Coastal Observatory who maintain a number of Datawell Directional WaveRider Mk III buoys off the coast around southeast England. The information for the Solent is taken from two buoys: One off the Coast of Hayling Island; and one off the New Forest Coast at Lymington. The data is collected every half hour by the buoys. Additional data is also collected by Cefas from a station in Fawley Power Station, both these datasets are shown. The Hadley Center collects SST data globally and this is used by Defra to show the change in coastal sea surface temperature round the UK.

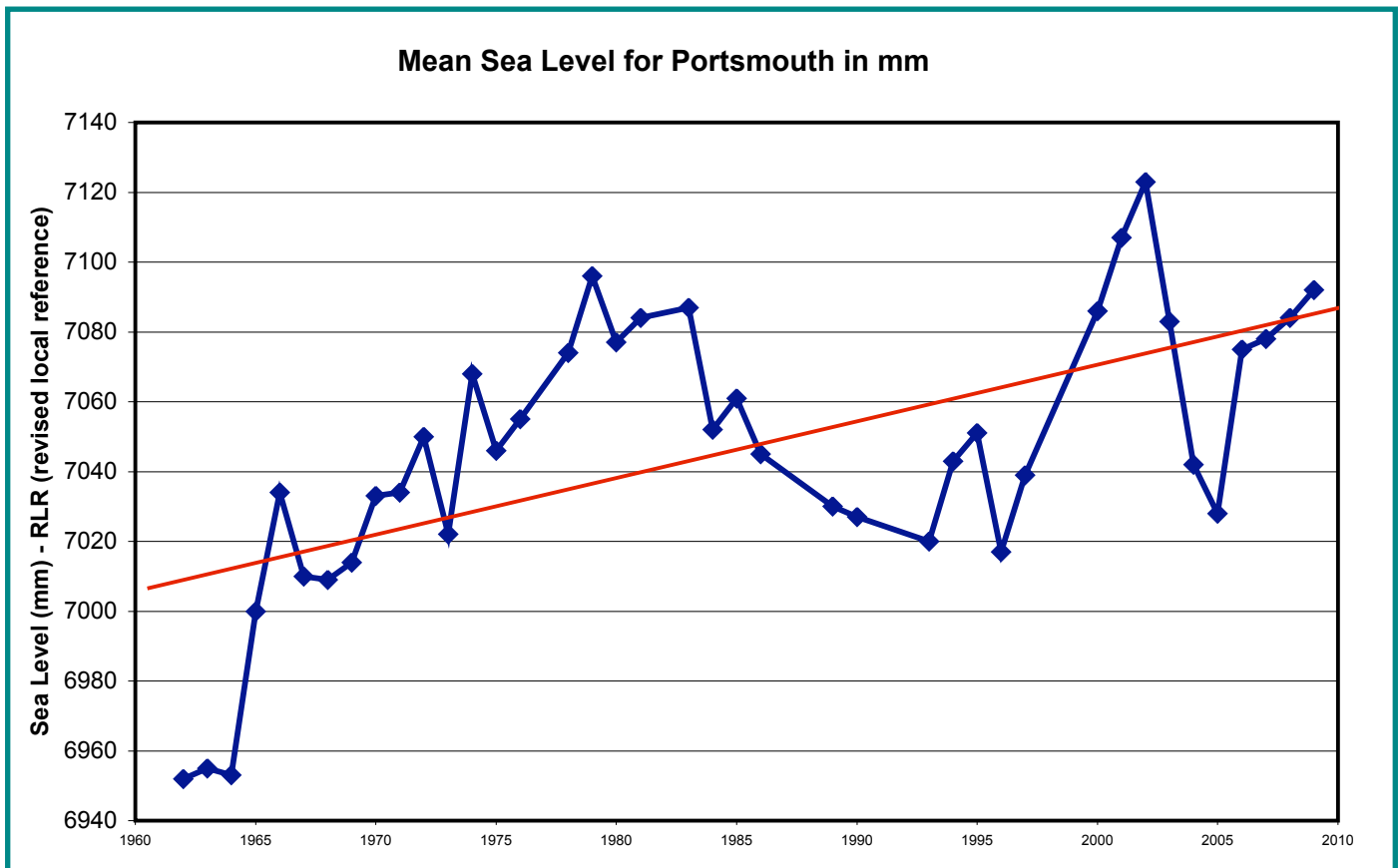
What the Indicator Shows

This data has been collected in the Solent since 2003 by the Channel Coastal Observatory and from the data the SST has been fairly stable but we would need a longer data series to make any further observations. The Fawley data has been collected since 1983 and again from the graph it is hard to establish any long term trends. However Cefas have grouped data from coastal stations together and looked at the annual temperature anomaly from a base period of 1970 to 2000 and have found that there is a rise in the SST of the coastal regions around the UK. While it is interesting and useful to know what is happening at the local level this indicator is more likely to be of greater value when looked at for the Eastern Channel and national levels as is being done by Cefas.

What are the implications for coastal planning and management

If we assume that, like in other areas, SST in the Solent is increasing over time this is an indicator of climate change and its associated impacts, such as changes in weather patterns and species composition. Issues such as increases in the number of algae blooms need to be planned for in the future.

1.2 Indicator: Relative Sea Level Rise



Source: Permanent Service for Mean Sea Level (PSMSL)

Reason for Indicator Selection

Relative sea level rise is one of the greatest pressures facing the coastal zone. It is generally accepted that sea levels are rising due to the effect of climate change. Climate change is also predicted to increase the number of storm events which can lead to an increase in wave heights and this in combination with rising sea levels will have a large impact on our coast and its management. In particular it will have an impact of the sustainability of present coastal defence policies and strategies as well as the cost of defences.

This indicator is used at the national level by a number of countries and has also been used widely at the EU level. It is one of the Environment Agency's State of the Environment Indicators and they have used the same data set as we have for the Solent.

Where does the data come from?

The Proudman Oceanography Laboratory host the Permanent Service for Mean Sea Level (PSMSL). The PSMSL was established in 1933, and is the global data bank for long term sea level change information from tide gauges. The PSMSL collect data from several hundred gauges situated all over the globe. One of these gauges is situated in Portsmouth Harbour and this information is used for the indicator. Mean sea level at the coast is defined as the height of the sea with respect to a local land benchmark, averaged over a period of time long enough that fluctuations caused by waves and tides are largely removed, such as a month of a year. The data set used is known as the Revised Local Reference and this has been the basis of all analyses of secular changes in global sea level during the last century.

What the Indicator Shows

Relative sea level varies constantly due to a range of physical processes, such as waves, tides, and movement. The information from the gauge in Portsmouth shows that there is a general trend of rising sea levels over the past 40 years. However, within this trend there have been fluctuations, for example between 1980 and 1990 sea levels in this area were seen to fall. For the period between 1962 and 2008 the sea level has risen by 132 mm, this is an average rise of 2.9 mm per year. It can be seen from the graph that the relative sea level fluctuations are pronounced and it is therefore important to look at the trends over longer terms as short term trends could be misleading.

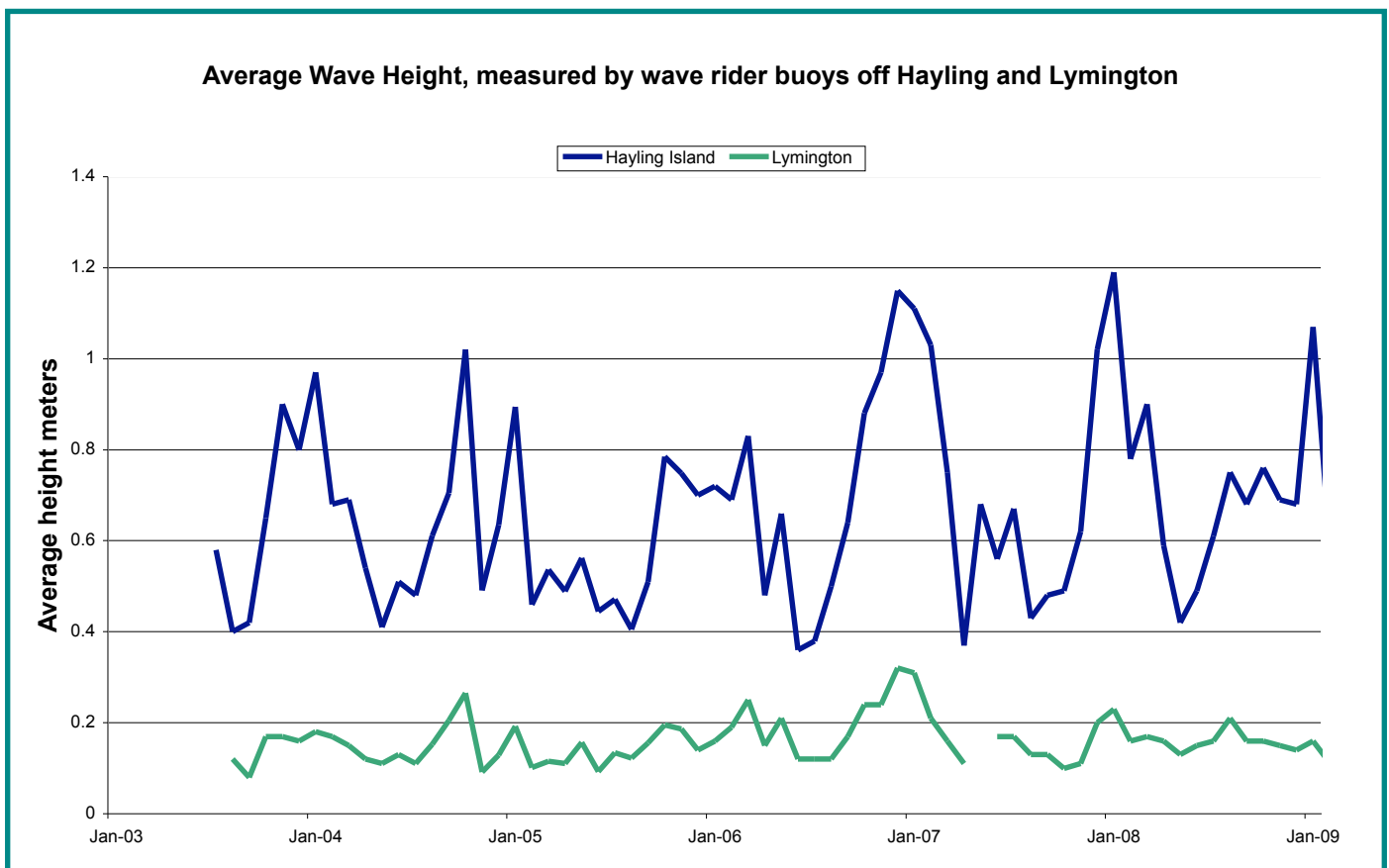
This indicator is also used at the UK national level as one of the ten climate change indicators and the picture nationally is that in the southeast sea level is rising. The prediction for the future is that it will continue to rise and the rate by which the level rises will increase.

Implications for Coastal Planning and Management

The extent to which sea level rise will continue in the Solent will have important consequences for coastal defence and spatial planning. At present as most of the Solent's coastline is defended and much is highly populated it will be important that coastal defence policies take into account the increasing sea levels and potential increase in storm events which may be caused by climate change.

The second generation Shoreline Management Plans have looked at these issues in detail and taken into account the International Panel on Climate Change (IPCC) predicted rates of sea level rise. They are currently developing coastal defence policies for short, medium and long time scales. It is important that these policies are fully incorporated with the spatial and future marine planning system.

1.3 Indicator: Average Wave Height



Source: Channel Coastal Observatory

Reason for Indicator Selection

One of the predicted consequences of climate change is an increase in storm events. A measure of this may be an increase in average wave height. It is also important with regard to coastal defences in the region as they will be impacted if the average wave high increases or decreases.

Where does the data come from?

The data is freely available on the internet from the Channel Coastal Observatory who maintain a number of Datawell Directional WaveRider Mk III buoys off the coast round southeast England. The information for the Solent is taken from two buoys: one off the Coast of Hayling Island, and one off the New Forest Coast at Lymington. The data is collected every half hour by the buoys.

What the Indicator Shows

There is a lot of seasonal variation in the average wave height with it being higher in the winter than in the summer. It is also higher in the less sheltered of the two locations, Hayling Island. It is not possible to get a trend as the data has not been collected for long enough but this will be possible in the future.

Implications for coastal planning and management in the Solent

None at present as no trend determined at this time.

Further Information

Sea Surface Temperature

- Channel Coastal Observatory: http://www.channelcoast.org/data_management/real_time_data/charts/?chart=71
- Cefas data <http://www.cefas.co.uk/our-science/observing-and-modelling/monitoring-programmes/sea-temperature-and-salinity-trends/presentation-of-results/station-22-fawley-ps.aspx>.
- Cefas interpretation of SST around the UK: <http://www.cefas.co.uk/our-science/observing-and-modelling/monitoring-programmes/sea-temperature-and-salinity-trends/area-groupings-and-findings.aspx>
- Hadley centre global information on SST: <http://ukclimateprojections.defra.gov.uk/content/view/757/500/>.
- Defra Climate Predictions Website, <http://ukclimateprojections.defra.gov.uk/>

Relative sea level rise

- Proudman Lab: <http://www.pol.ac.uk/psmsl/>.
- Environment Agency State of the Environment: State of the Environment South East: http://www.environment-agency.gov.uk/static/documents/Business/SoE_March_2010.pdf
- SMP Isle of Wight: http://www.coastalwight.gov.uk/smp/draft_July_2010.htm
- SMP North Solent: <http://www.newforest.gov.uk/index.cfm?articleid=6554&articleaction=nthsInt&CFID=37325360&CFTOKEN=21609781>
- IPCC, <http://www.ipcc.ch/index.htm>

Wave Heights

- Channel Coastal Observatory: http://www.channelcoast.org/data_management/real_time_data/charts/?chart=71